

perceived in the expected territory of the known anatomical distribution of the root, (2) aggravated by postures or maneuvers which physically encroach on the nerve root including the Valsalva maneuver and (3) relieved by measures which ease mechanical distortion of the neural tissue. Problems arise, however, in assessing disease when the indirect or referred-pain mechanisms are presumed to be operative in the absence of evidence of direct neural involvement. An example in point is the inadequately supported proposal that headache, as the dominant symptom, on occasion can be attributed to C5-6 or C6-7 intervertebral disc disease and effectively treated by such operative procedures as disc excision with or without interbody fusion.

When a comprehensive history and examination exhaust the other causes of direct and primary neural involvement leaving cervical disc disease as the remaining consideration to explain the pain syndrome, the diagnostic battery of neck manipulation, plain radiological study and contrast myelography are indicated. The precise identification of the offending disc may be substantially aided by the additional use of *analgesic* discography whereby surgical procedures may be avoided upon cervical interspaces which, while possibly diseased, are not responsible for the pain.

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## Revolution in Neurodiagnosis: Computed Tomography of the Brain

COMPUTED TOMOGRAPHY (CT scan) of the brain has revolutionized neurodiagnosis as did ventriculography and pneumography in the 1920's, cerebral angiography in the 1940's and radioisotope brain scanning in the 1950's. Scanning technology is evolving rapidly to provide faster scans with finer resolution and display of the brain in coronal as well as horizontal slices. Except in showing vascular abnormalities (occlusive disease, aneurysm, arteriovenous anomaly, tumor blood supply) and lesions adjacent to the skull base (parasellar neoplasms), computed tomography has greatly diminished the use of pneumography, arteriography and radioisotope scanning. However, the occasionally false positive or negative CT scan de-

mands that interpretation be expert and the scan be correlated with the clinical evaluation of a neuroclinician. The CT scan cannot replace the history and physical examination. In many cases the traditional neurodiagnostic studies will have to provide the diagnosis or supplement the CT scan.

The CT scan is a rapid, safe and noninvasive procedure except for uncooperative adults and children, in whom heavy sedation or general anesthesia may be required to control motion artifact. Large volume contrast enhancement risks allergic reactions.

The CT scan complements arteriography in the evaluation of the stroke syndrome since it accurately differentiates cerebral infarction and cerebral hemorrhage. However, in 20 percent of cerebral infarctions enhanced contrast occurs in the first week and they must be differentiated from a neoplasm. Hemorrhage in certain sites suggests aneurysmal bleeding and directs definitive arteriography.

The CT scan with contrast shows 95 percent of supratentorial and infratentorial neoplasms and shows tumor cysts and peritumoral edema. The scan also displays the number of metastatic cerebral lesions more accurately than other procedures. Postoperative tumor recurrence and the effectiveness of radiotherapy and chemotherapy can be ably evaluated by serial CT scans.

Earlier diagnosis of brain abscess is possible with the contrast enhanced CT scan. Serial scans follow the size of the abscess cavity and show the presence of daughter abscesses in need of drainage better than any other procedure.

The management of craniocerebral trauma is aided greatly by immediate serial CT scanning. The scan differentiates contusion and edema from intracerebral hematoma and displays the dynamic evolving pathological conditions of brain injury (multiple lesions, hematomas in the posterior fossa and frontal areas, delayed parenchymal hematomas, correctable postoperative complications) better than other diagnostic procedures. Occasionally, a subdural hematoma is isodense with brain tissue on CT scan and arteriography may be necessary to aid in the diagnosis.

The CT scan simplifies the evaluation in a neonate or infant with a large head and helps to select those patients in whom invasive diagnostic procedures are required. Serial scans display changes in ventricular size and aid in management decisions in the long-term care of hydrocephalus.

At the same time we accept the benefits of the CT scan, we must realize that uncontrolled requisitioning of the scan in the absence of clinical indications is an expensive abuse of a fine procedure.

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## Treatment of Peripheral Nerve Injuries

TRAUMA TO a peripheral nerve may be by blunt force to the soft tissues, traction caused by dislocation or fracture of adjacent bone, or a compound wound with direct laceration. Correct diagnosis and management is based on analysis of the following features: (1) nature of injury, (2) status of nerve function distal to wound, (3) inspection of wound, (4) site of wound in relation to known anatomical positions of nerves and (5) severe injuries to soft tissues, tendons, bones or joints.

Unless there is progressing neurological deficit, treatment of blunt trauma is expectant and non-surgical for four to eight weeks, with frequent neurological reevaluation and serial electromyography to determine the need for exploration and possibly neurolysis.

Primary suture of the divided nerve after a compound injury should be done only under ideal conditions; that is, (1) a cleanly lacerated nerve without crush or adjacent tissue damage, (2) minimal contamination, (3) approximation of nerve ends without stretching and without extending the incision, (4) repair within 24 hours of injury and (5) a competent and experienced surgeon using the latest techniques of nerve repair. Except in the rare situation presenting these favorable conditions, the nerve ends should be identified and tagged for subsequent fascicular orientation by sutures on matching anatomical positions of each nerve end. An overlapping stay suture of non-absorbable material may be used to prevent retraction of the nerve ends. Secondary suture should then be done in three to six weeks, after associated injuries have resolved and satisfactory skin protection is present.

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## The Warning Leak as a Clue to the Presence of an Intracranial Aneurysm

THE GENERALLY ACCEPTED statistic that a 50 per cent mortality is associated with the initial rupture of an intracranial aneurysm contributes to the nihilistic approach to this condition by many physicians. It is important to recognize that this need not be the case, however, as evidenced by recent reports that many patients who suffer a devastating subarachnoid hemorrhage have experienced a mild or "warning" leak in the weeks preceding the major ictus which has gone unrecognized by their physician. One can only speculate that had the "warning leak" been investigated thoroughly the aneurysm might have been repaired and there might have been a much more favorable outcome.

The most important adjunct to recognizing a "warning leak" is to be aware that they do occur. However, a brief review of the subject may offer additional assistance to the busy physician confronting a patient with the all too frequent complaint of headache. Unfortunately, headache is the only symptom of "warning leak" because there is no associated neurologic deficit. There is nothing specific about the headache of a "warning leak" to separate it from other causes of head pain, so the differentiation must be made on the basis of the individual circumstances. The best first step is to exclude the common headache syndrome.

- *Migraine headache.* Migraine headache is a specific syndrome which is usually very familiar to a migraine sufferer because he or she has had it for many years. It begins on one side of the head, is throbbing in character and is relieved by administration of a mixture of ergotamine tartrate and caffeine (Cafergot®).

- *Tension headache.* Most people with tension headache have a headache pattern with slow buildup suboccipitally. They also usually have a long history of headache and are not sufficiently incapacitated that they cannot continue to function.

- *Sinus headache.* Sinus headache is usually associated with fever, nasal discharge and tenderness over the involved sinus. Most people with sinus headache have a history of previous episodes in the past.

- *Cluster headache.* Cluster headache is almost always associated with pain about the eye and tearing, conjunctival erythema or nasal stuffiness.